CLAIMS

What is claimed is:

1. A tunable quantum well infrared photodetector focal plane array (QWIP FPA) imaging device, comprising:

one or more detector layers including asymmetric quantum wells, each detector layer between contact layers, thereby defining a stack of layers having a front side and a back side, wherein each detector layer has a spectrum of light absorption that changes in response to an applied bias;

a light-coupling grating formed on the backside of the stack, the grating having a pattern that reflects a substantial portion of incoming light so as to disperse that light through the one or more of the detector layers, thereby facilitating absorption; and

a reflective coating on sides of the detector layers so as to provide, in conjunction with the light-coupling grating, a photon-in-a-box configuration for containing light.

2. The device of claim 1 wherein each detector layer is not more than about one micron in thickness.

3. The device of claim 1 further comprising a read-out integrated circuit (ROIC) that includes biasing circuitry adapted to deliver bias signals to each detector layer thereby enabling tunability of the corresponding spectrum of light absorption.

4. The device of claim 3 wherein each contact layer of the device is electrically coupled to a backside contact, thereby facilitating connection to the ROIC.

5. The device of claim 3 wherein the ROIC further includes an image processor adapted to receive pixel data from each detector layer and to generate corresponding images associated with the pixel data.

6. The device of claim 1 wherein the stack of layers is one multicolor pixel of the device, and is repeated a number of times thereby defining an array of the multicolor pixels.

7. The device of claim 1 wherein each asymmetric quantum well is a unit cell comprising two quantum wells coupled by a barrier, where one of the quantum wells is configured to absorb a first spectrum, and the other quantum well is configured to absorb a second spectrum.

8. The device of claim 7 wherein the quantum well configured to absorb the second spectrum includes a well spike.

9. The device of claim 7 wherein applying a first bias causes the first spectrum to be dominant and applying a second bias causes the second spectrum to be dominant.

10. The device of claim 1 wherein applying a first bias causes a first spectrum of absorption to be dominant and applying a second bias causes a second spectrum of absorption to be dominant.

11. A tunable quantum well infrared photodetector focal plane array (QWIP FPA) imaging device, comprising:

one or more detector layers each including a plurality of asymmetric unit cells, each detector layer between contact layers, thereby defining a stack of layers having a front side and a back side;

wherein each unit cell includes two quantum wells coupled by a barrier, and one of the quantum wells is configured to absorb a first spectrum in response to a first bias being applied, and the other quantum well includes a well spike and is configured to absorb a second spectrum in response to a second bias being applied.

12. The device of claim 11 further comprising a read-out integrated circuit (ROIC) that includes biasing circuitry adapted to deliver the first and second bias signals to each detector layer thereby enabling spectral tunability of the device.

13. The device of claim 12 wherein each contact layer of the device is electrically coupled to a backside contact, thereby facilitating connection to the ROIC.

14. The device of claim 12 wherein the ROIC further includes an image processor adapted to receive pixel data from each detector layer and to generate corresponding images associated with the pixel data.

15. The device of claim 11 wherein the stack of layers is one multicolor pixel of the device, and is repeated a number of times thereby defining an array of the multicolor pixels.

16. A tunable quantum well infrared photodetector focal plane array (QWIP FPA) imaging device, comprising:

one or more detector layers including asymmetric quantum wells, each detector layer between contact layers, thereby defining a stack of layers having a front side and a back side, wherein each detector layer has a spectrum of light absorption that changes in response to an applied bias;

a read-out integrated circuit (ROIC) that includes biasing circuitry adapted to deliver bias signals to each detector layer thereby enabling spectral tunability; and

an image processor adapted to receive pixel data from each detector layer and to generate corresponding images associated with the pixel data.

17. The device of claim 16 wherein the stack of layers is one multicolor pixel of the device, and is repeated a number of times thereby defining an array of the multicolor pixels, from each of which the image processor receives pixel data.

18. The device of claim 16 wherein each asymmetric quantum well is a unit cell comprising two quantum wells coupled by a barrier, where one of the quantum wells is configured to absorb a first spectrum, and the other quantum well includes a well spike and is configured to absorb a second spectrum.

19. The device of claim 18 wherein applying a first bias causes the first spectrum to be dominant and applying a second bias causes the second spectrum to be dominant.

20. The device of claim 16 wherein applying a first bias causes a first spectrum of absorption to be dominant and applying a second bias causes the second spectrum of absorption to be dominant.